STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

TECHNICAL SERVICES DIVISION
RESEARCH & DEVELOPMENT SECTION

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EXPERIMENTAL CONSTRUCTION 92-34

FIELD TRIAL OF GRAVEL STABILIZATION METHODS
ROUTE 1 CYR-VAN BUREN, ME

2ND INTERIM REPORT

INTRODUCTION

This experimental construction project was developed, designed, and inspected by personnel from the University of Maine, Civil Engineering Staff The experimental project was constructed on and as a part of Project #2586 00 This was a complete reconstruction project 3 54 km (2 2 miles) in length The experimental section contains 6 experimental base types and is 310 km (1020 feet) in length The experimental section began at Station 1028+00 and ended at Station 1038+20 The test section consisted of 60 m (200 foot) segments of soil-cement, asphalt-stabilized, and calcium chloride-stabilized materials, as well as two control sections and one 6 m (20 foot) untreated section The stabilized and control sections were located as follows

Soil-Cement Stabilized	STA 1028+00 to 1030+00
Modified Subbase Control	STA 1030+00 to 1032+00
Asphalt Stabilized Section	STA 1032+00 to 1034+00
Untreated Section	STA 1034+00 to 1034+20
Calcium Chloride Stab Section	STA 1034+20 to 1036+20
Standard Subbase Control	STA 1036+20 to 1038+20

Work on this project started in September 1990 and was completed in the summer of 1991 A construction report "Experimental Construction 92-34" was written in Dec 1991 which provided a background of stabilization agents, their uses, advantages and disadvantages This report also provided preliminary design results as well as test results obtained during the construction phases In addition to the test results a plan for long term monitoring was also included in Appendix G Some of the features to be monitored are rutting, and serviceability such as roughness and overall performance Strength measurements using a Road Rater was also suggested Most of the evaluations can be performed with the ARAN vehicle and the Road Rater Long term monitoring of the calcium chloride is specifically mentioned For this phase they recommend that test pits be dug every 5 years in order to monitor the possible leaching away of the calcium chloride

RESULTS

This second Interim report covers the period of time from June 1993 through December 1994 During this period of time ARAN rut depth information was gathered for both years, but Roughness information in terms of International Roughness Index was measured only in 1993 Road-rater deflection data was obtained both years

The rut depth results are presented in Table 1 These tabulated results are beginning to show a pattern These results indicate that the rut depths are increasing with time or traffic Observations also indicate that the inner wheel path has deeper ruts than the outer wheel path Usually the outer wheel path shows deeper ruts However, recent observations by pavement management personnel indicate that this characteristic is not uncommon on roads with paved shoulders The deepest ruts are located in the northbound lane on the inner wheel path During the last 3 years the rut depths have increased from 1 3 mm to 5 2 mm (0 053" to 0 204") on the inner wheel path on the north bound lane The relatively high rut depth on the soil cement section may indicate that the some of the rutting may be in the asphalt pavement This same data indicates that the asphalt stabilized base also contains greater ruts than the granular bases The calcium chloride section is performing similar to the granular bases sections While these differences have been compared and commented on, in reality, the rut depths throughout this test area are not any different than anticipated on most roads at this age

Another physical property measured was the roughness of the road These results are presented in Table 2 These measurements were taken as part of the highway system inventory data bank, and as a result only the northbound lane was tested The roughness values obtained indicate that all sections are performing well above the accepted criteria of 4830 mm (190 inches) This value is considered as a smooth road according to ASTM specifications These international roughness index values (IRI) indicate that the poorest riding test section is the one with the asphalt stabilized base

Visual inspection of the roadway by means of ARAN video tapes taken August 30, 1994 reveal that 4 transverse cracks have developed This number indicates that a crack has developed approximately every 91 m (300 feet) These same cracks were reported in the 1st Interim Report dated May 1993

The structural condition of the various test sections were measured using the Road-rater The results presented in Table 3 indicate the following

- The soil-cement section is the strongest section
- The asphalt stabilized section and the control section have equal strength
- The calcium chloride section has slightly less strength than most other sections

Further interpretation of the results are as follows

- The first 2 columns, with 76 mm and 120 mm (3" and 4¾") pavement thickness, are deflection results taken during construction These will not be discussed in this report
- The "Effective Pavement Thickness" section of Table 3 is based on the elastic theory Basically the deflection bowl is used to compute a subgrade modulus (this is section titled "Computed Subgrade Value") The computer program assumes a 610 mm (24") aggregate subbase The elastic theory calculates the "Effective Pavement Thickness" using the subgrade values and an assumed 610 mm (24") base The results show the pavement behaving as though it has a thickness between 100 mm and 145 mm (4" and 5 7")
- The "Pavement Required" is calculated using the structural number concept with the "Computed Subgrade Values" These numbers range from less than 25 mm to 103 mm (1" to 4 07")
- The difference between the "Effective Pavement Thickness" and the "Pavement Required" is the "Overlay Required" As can be seen all values are negative which indicates no overlay is needed It can be assumed that the lower these negative values the stronger the pavement

The June 1994 readings show that the effective pavement thickness are slightly less than the 1993 data This weakening may be caused by either spring seasonal factors used in the computations or by actual depreciation caused by traffic Regardless, the various sections are performing well structurally

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Other Available Documents
Construction Report Dec 1991
1st Interim Report May 1993

TABLE 1
PHYSICAL PROPERTIES
RUT DEPTHS (Inches)

	SOUTHBOUND LANE		NORTHBOUND LANE	
	Outer WP	Inner WP	Inner WP	Outer WP
1991				
Standard Subbase	Missing	Missing	0.050	0.063
Calcium Chloride	"	"	0.050	0.088
Untreated	"	"	0.000	0.100
Asphalt Stab	"	"	0.088	0.038
Modified Subbase	"	"	0.050	0.038
Soil Cement	"	"	0.088	0.038
1992				
Standard Subbase	0.090	0.040	0.075	0.033
Calcium Chloride	0.033	0.010	0.115	0.054
Untreated	0.000	0.000	0.200	0.100
Asphalt Stab	0.067	0.025	0.175	0.075
Modified Subbase	0.092	0.025	0.108	0.003
Soil Cement	0.083	0.033	0.145	0.091
1993				
Standard Subbase	0.100	0.150	0.150	0.250
Calcium Chloride	0.000	0.000	0.125	0.050
Untreated	0.000	0.000	0.200	0.100
Asphalt Stab	0.050	0.025	0.250	0.120
Modified Subbase	0.025	0.025	0.150	0.075
Soil Cement	0.100	0.175	0.200	0.150
1994				
Standard Subbase	0.125	0.150	0.150	0.050
Calcium Chloride	0.025	0.100	0.175	0.075
Untreated	0.000	0.200	0.200	0.000
Asphalt Stab	0.025	0.100	0.250	0.100
Modified Subbase	0.025	0.100	0.200	0.175
Soil Cement	0.200	0.100	0.250	0.200

TABLE 2
PHYSICAL PROPERTIES
INTERNATIONAL ROUGHNESS INDEX (in Inches)

Station	Mile	1991 SBL	1991 NBL	1992 SBL	1992 NBL	1993 SBL	1993 NBL	1994 SBL	1994 NBL
Sta 1038+20	483.922								
Standard "CONTROL" 200 Ft		M	42.23	M	M	M	78.19 76 38	M	M
T/L 1036+50	483 89								
Sta 1036+20	483 884								
Calcium Chloride 200 Ft		M	47.09	M	M	M	77.26 92 82	M	M
Sta 1034+20	483 8464								
Untreated (Short) 20 Ft		M	M	M	M	M	M	M	M
Sta 1034+00	483.8427								
Asphalt Stab Base 200 Ft		M	70.97	M	M	M	108.07 133.99	M	M
Sta 1032+00	483 8048								
Modified B "CONTROL" 200 Ft		M	58 09	M	M	M	M	M	M
Sta 1030+00	483 7669								
Soil Cement 200 Ft		M	55 67	M	M	M	M	M	M
Sta 1028+00	483.729								

M represents Missing Data

Roughness Readings Taken in Inner Wheelpath Only

TABLE III
CONSOLIDATED ROAD-RATER RESULTS
@ CYR PLANTATION / VAN BUREN
UMO EXPERIMENTAL BASE STUDY

Thickness	3"	4 3/4"	6"	6"	6"	6"
Date Measured	9/28/90	5/21/91	8/6/91	9/16/92	9/8/93	6/14/94
DEFLECTION # 1 SENSOR (Mils) (Not temperature corrected)						
STANDARD B	4.49	3.55	2.04	1.47	1.35	1.36
MOD SUBBASE	4.15	3.83	2.01	1.44	1.35	1.52
ASPH STAB B	4.18	2.79	1.60	1.24	1.11	1.36
$CaCl_2$ STAB	4.21	3.20	2.05	1.54	1.47	1.43
SOIL CEMENT	2.30	2.52	1.37	1.05	1.03	1.18
** COMPUTED SUBGRADE VALUE (ksi)						
STANDARD B	1.33	2.00	5.93	18.70	10.47	9.44
MOD SUBBASE	1.77	1.46	5.20	16.88	10.31	10 19
ASPH STAB B	1.69	3.37	9.43	20.10	16.95	19.17
$CaCl_2$ STAB	1.86	2.68	5.84	16.68	9.78	10.99
SOIL CEMENT	8.70	4.27	15.92	20.83	30.18	22.35
** EFFECTIVE PAVEMENT THICKNESS (Inches)						
STANDARD B	0.00	2.14	5.41	4.00	5.48	5.53
MOD SUBBASE	0.00	1.49	5.57	4.13	5.62	4.95
ASPH STAB B	0.00	2.48	5.62	4.74	5.61	4.09
$CaCl_2$ STAB	0.03	2.77	5.71	4.14	5.66	4.99
SOIL CEMENT	2.41	2.96	5.42	5.49	4.95	4.65
** PAVEMENT REQUIRED (Inches)						
STANDARD B	9.30	7.54	3.89	1.09	2.4	1.85
MOD SUBBASE	8.39	8.33	4.07	1.09	2.41	1.70
ASPH STAB B	8.17	5.15	2.43	0.85	1.2	0.41
$CaCl_2$ STAB	8.51	6.56	3.93	1.48	2.78	1.52
SOIL CEMENT	2.98	4.65	1.31	0.58	0.17	0.20
** OVERLAY REQUIRED (Inches)						
STANDARD B	9.30	5.40	-1.52	-2.91	-3.08	-3.68
MOD SUBBASE	8.39	6.84	-1.50	-3.03	-3.21	-3.24
ASPH STAB B	8.47	2.97	-3.19	-3.90	-4.41	-3.68
$CaCl_2$ STAB	8.48	3.79	-1.78	-2.66	-2.89	-3.47
SOIL CEMENT	0.57	1.69	-4.11	-4.90	-4.78	-4.45

** Temperature corrected deflections were used in Calculations